ABSTRACTS

EPIGENETICS AND SEX CONTROL IN FISH FARMING

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We now know that early environmental conditions can influence an individual's future phenotype. As a mediator between environmental signals and phenotypic responses, epigenetics raises many hopes but also many questions in aquaculture, as in most agricultural production sectors. We will present the main principles regarding the Maternal & Paternal transmission of epigenetic patterns and the transgenerational epigenetic inheritance. Epigenetic mechanisms can be in the form of DNA methylation, Histone variants, chromatin remodelling and post-translational modifications with non-coding RNA. We will show from recent fish examples, how it should be quickly used and taken into account especially for sex control in aquaculture.

The first potential application of epigenetics in aquaculture is by environmental manipulation of the fry or bloodstock. It relies on studies carried out on 3 species. In sea bass, *Dicentrarchus labrax*, high temperatures applied at early stages of development induce hyper-methylation in the promoter region of the aromatase gene (*cyp19a1a*), which inhibits the expression of this gene and leads to fry masculinization (Navarro-Martin et al., 2011). In the half-smooth tongue sole, *Cynoglossus s emilaevis*, the pseudo-male testes induced by early treatment of genetic females at high temperatures exhibit methylation patterns comparable to those of genetic males, but different from those encountered in the ovaries of genetic females. The pseudomale phenotype and its methylation patterns are found in F1 resulting from crosses between pseudomales and normal females, suggesting a transgenerational effect of masculinization induced by high temperatures in this species (Shao et al., 2014). The third species studied has been the Nile tilapia where temperature treatments can induce masculinization of XX individuals resulting in higher levels of DNA methylation in both promoters and gene bodies (Sun et al., 2016).

The second approach, validated on oil content in oil palm, consists in integrating the presence or absence of epigenetic marks in epigenetic selection programmes.

Epigenetics is involved in the development and maintenance of the phenotype, including a sexual phenotype. A better understanding of epigenetic mechanisms will allow a functional annotation of genomes, but also to anticipate and probably to select (via epigenetic markers) the phenotypes induced by certain early environmental conditions. Epigenetics should be rapidly integrated into aquaculture practices and selection schemes, especially for sex control purposes.